REVISIONS			
LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
A	Changes to recommended operating conditions and table I. Add vendors FSCM 27014 and 18714.	1986 JAN 28	W. Heckman
B	Convert to standardized military drawing format. Add vendor CAGE 27014 to device type 012X. Technical changes to 1.4 and table I. Device 01BX inactive for new design. Not available from an approved source of supply. Device types 01CX and 012X are inactive for new design, use QPL device. Change code identification number to 67268. Editorial changes throughout.	1989 AUG 4	W. Heckman

CURRENT CAGE CODE 67268

REV																			
SHEET																			
REV																			
SHEET																			

REV STATUS OF SHEETS																
REV	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13			

PMIC N/A

STANDARDIZED MILITARY DRAWING

THIS DRAWING IS AVAILABLE FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE

AMSC N/A

PREPARED BY
Jeffery Tunstall

CHECKED BY
RAY MONNIN

APPROVED BY
William K. Heckman

DRAWING APPROVAL DATE
30 July 1985

REVISION LEVEL
B

DEFENSE ELECTRONICS SUPPLY CENTER
DAYTON, OHIO 45444

MICROCIRCUIT, DIGITAL, HIGH-SPEED CMOS, 8-BIT SERIAL-IN/PARALLEL SHIFT REGISTER, MONOLITHIC SILICON

SIZE	CAGE CODE	
A	14933	84162

SHEET 1 OF 13

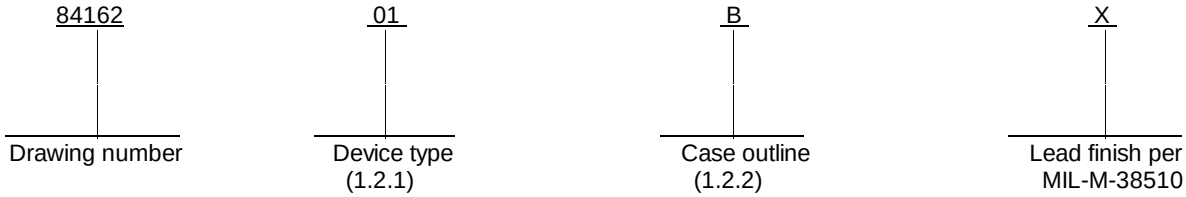
DESC FORM 193-1
SEP 87

* US GOVERNMENT PRINTING OFFICE: 1987--748-129/60912
5962-E1112-2

1. SCOPE

1.1 Scope. This drawing describes the requirements for monolithic silicon, high-speed CMOS 8-bit shift register logic microcircuits. This drawing provides a level of microcircuit quality and reliability assurance for acquisition of microcircuits in accordance with MIL-M-38510.

1.2 Part number. The complete part number shall be as shown in the following example:



1.2.1 Device type. The device type shall identify the circuit function as follows:

Device type	Generic number	Circuit function
01	54HC164	8-bit shift register serial-in/parallel-out

1.2.2 Case outlines. The case outlines shall be as designated in appendix C of MIL-M-38510, and as follows:

Outline letter	Case outline
B	F-3 (14-lead, .280" x .200" x .070"), flat package
C	D-1 (14-lead, .785" x .310" x .200"), dual-in-line package
D	F-2 (14-lead, .390" x .260" x .085"), flat package
2	C-2 (20-terminal, .358" x .358" x .100"), square chip carrier package

1.3 Absolute maximum ratings. 1/

Supply voltage range	-0.5 V dc to 7.0 V dc
DC input voltage range	-0.5 V dc to V_{CC} +0.5 V dc
DC output voltage range	-0.5 V dc to V_{CC} +0.5 V dc
Clamp diode current	±20 mA
DC output currents (per pin)	±25 mA
DC V_{CC} or GND current (per pin)	±50 mA
Storage temperature range	-65°C to +150°C
Maximum power dissipation, (P_D)	500 mW 2/
Lead temperature (soldering, 10 seconds)	260°C
Thermal resistance, junction to case (O_{JC})	See MIL-M-38510, appendix C
Junction temperature (T_J)	+175°C

1/ Unless otherwise specified, all voltages are referenced to ground.
2/ For T_C = +100°C to +125°C, derate linearly at 12 mW/°C.

1.4 Recommended operating conditions.

Supply voltage range ..... +2.0 V dc to +6.0 V dc
Case operating temperature range (T_C) ..... -55°C to +125°C
Input rise or fall time:
V_{CC} = 2.0 V ..... 0 to 500 ns max
V_{CC} = 4.5 V ..... 0 to 500 ns max
V_{CC} = 6.0 V ..... 0 to 400 ns max
Minimum setup time, A, B to CLK (t_s):
T_C = +25°C:
V_{CC} = 2.0 V ..... 100 ns
V_{CC} = 4.5 V ..... 20 ns
V_{CC} = 6.0 V ..... 17 ns
T_C = -55°C, +125°C:
V_{CC} = 2.0 V ..... 150 ns
V_{CC} = 4.5 V ..... 30 ns
V_{CC} = 6.0 V ..... 26 ns
Minimum hold time, CLK to A, B (t_h):
T_C = +25°C:
V_{CC} = 2.0 V ..... 25 ns
V_{CC} = 4.5 V ..... 5 ns
V_{CC} = 6.0 V ..... 5 ns
T_C = -55°C, +125°C:
V_{CC} = 2.0 V ..... 40 ns
V_{CC} = 4.5 V ..... 8 ns
V_{CC} = 6.0 V ..... 7 ns
Minimum pulse width, CLR or CLK (t_w):
T_C = +25°C:
V_{CC} = 2.0 V ..... 80 ns
V_{CC} = 4.5 V ..... 16 ns
V_{CC} = 6.0 V ..... 14 ns
T_C = -55°C, +125°C:
V_{CC} = 2.0 V ..... 120 ns
V_{CC} = 4.5 V ..... 24 ns
V_{CC} = 6.0 V ..... 20 ns
Maximum clock frequency (f_{MAX}):
T_C = +25°C:
V_{CC} = 2.0 V ..... 5 MHz
V_{CC} = 4.5 V ..... 25 MHz
V_{CC} = 6.0 V ..... 29 MHz
T_C = -55°C, +125°C:
V_{CC} = 2.0 V ..... 3.4 MHz
V_{CC} = 4.5 V ..... 17 MHz
V_{CC} = 6.0 V ..... 20 MHz
Minimum recovery time CLR to CLK (t_{REC}):
T_C = +25°C:
V_{CC} = 2.0 V ..... 100 ns
V_{CC} = 4.5 V ..... 20 ns
V_{CC} = 6.0 V ..... 17 ns
T_C = -55°C, +125°C:
V_{CC} = 2.0 V ..... 150 ns
V_{CC} = 4.5 V ..... 30 ns
V_{CC} = 6.0 V ..... 26 ns

2. APPLICABLE DOCUMENTS

2.1 Government specification and standard. Unless otherwise specified, the following specification and standard, of the issue listed in that issue of the Department of Defense Index of Specifications and Standards specified in the solicitation, form a part of this drawing to the extent specified herein.

SPECIFICATION

MILITARY

MIL-M-38510 - Microcircuits, General Specification for.

STANDARD

MILITARY

MIL-STD-883 - Test Methods and Procedures for Microelectronics.

(Copies of the specification and standard required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

3. REQUIREMENTS

3.1 Item requirements. The individual item requirements shall be in accordance with 1.2.1 of MIL-STD-883, "Provisions for the use of MIL-STD-883 in conjunction with compliant non-JAN devices" and as specified herein.

3.2 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-M-38510 and herein.

3.2.1 Terminal connections. The terminal connections shall be as specified on figure 1.

3.2.2 Logic diagram and truth table. The logic diagram and truth table shall be as specified on figure 2.

3.2.3 Case outlines. The case outlines shall be in accordance with 1.2.2 herein.

3.3 Electrical performance characteristics. Unless otherwise specified, the electrical performance characteristics are as specified in table I and apply over the full case operating temperature range.

3.4 Marking. Marking shall be in accordance with MIL-STD-883 (see 3.1 herein). The part shall be marked with the part number listed in 1.2 herein. In addition, the manufacturer's part nuimber may also be marked as listed in 6.4 herein.

3.5 Certificate of compliance. A certificate of compliance shall be required from an manufacturer in order to be listed as an approved source of supply in 6.4. The certificate of compliance submitted to DESC-ECS prior to listing as an approved source of supply shall state that the manufacturer's product meets the requirements of MIL-STD-883 (see 3.1 herein) and the requirements herein.

3.6 Certificate of conformance. A certificate of conformance as required in MIL-STD-883 (see 3.1 herein) shall be provided with each lot of microcircuits delivered to this drawing.

TABLE I. Electrical peformance characteristics.

Test	Symbol	Conditions 1/ $-55°C \le T_C \le +125°C$ unless otherwise specified		Group A subgroups	Limits		Unit
					Min	Max	
High level output voltage	V_{OH}	$V_{IN} = V_{IH}$ minimum or V_{IL} maximum $\lvert I_O \rvert \le 20$ µA	V_{CC} = 2.0 V	1, 2, 3	1.9		V
			V_{CC} = 4.5 V		4.4		
			V_{CC} = 6.0 V		5.9		
		$V_{IN} = V_{IH}$ minimum or V_{IL} maximum $\lvert I_O \rvert \le 4$ mA	V_{CC} = 4.5 V		3.7		
		$V_{IN} = V_{IH}$ minimum or V_{IL} maximum $\lvert I_O \rvert \le 5.2$ mA	V_{CC} = 6.0 V		5.2		
Low level output voltage	V_{OL}	$V_{IN} = V_{IH}$ minimum or V_{IL} maximum $\lvert I_O \rvert = \le 20$ µA	V_{CC} = 2.0 V	1, 2, 3		0.1	V
			V_{CC} = 4.5 V			0.1	
			V_{CC} = 6.0 V			0.1	
		$V_{IN} = V_{IH}$ minimum or V_{IL} maximum $\lvert I_O \rvert = \le 4.0$ mA	V_{CC} = 4.5 V			0.4	
		$V_{IN} = V_{IH}$ minimum or V_{IL} maximum $\lvert I_O \rvert = \le 5.2$ mA	V_{CC} = 6.0 V			0.4	
High level input voltage	V_{IH}	2/	V_{CC} = 2.0 V	1, 2, 3	1.5		V
			V_{CC} = 4.5 V		3.15		
			V_{CC} = 6.0 V		4.2		

See footnotes at end of table.

TABLE I. Electrical peformance characteristics - Continued.

Test	Symbol	Conditions 1/ $-55°C \le T_C \le +125°C$ unless otherwise specified		Group A subgroups	Limits Min	Limits Max	Unit
Low level input voltage	V_{IL}	2/	V_{CC} = 2.0 V	1, 2, 3		0.3	V
			V_{CC} = 4.5 V			0.9	
			V_{CC} = 6.0 V			1.2	
Input capacitance	C_{IN}	V_{IN} = 0.0 V See 4.3.1c	T_C = +25°C	4		10	pF
Quiescent supply current	I_{CC}	V_{CC} = 6.0, V_{IN} = V_{CC} or GND		1, 2, 3		160	µA
Input current	I_{IN}	V_{CC} = 6.0, V_{IN} = V_{CC} or GND		1, 2, 3		±1.0	µA
Functional tests		See 4.3.1d		7			
Propagation delay time, CLK to Qn (see figure 3) 3/	t_{PHL1}, t_{PLH1}	T_C = +25°C, C_L = 50 pF ±10%	V_{CC} = 2.0 V	9		175	ns
			V_{CC} = 4.5 V			35	
			V_{CC} = 6.0 V			30	
		T_C = -55°C, +125°C, C_L = 50 pF ±10%	V_{CC} = 2.0 V	10, 11		265	ns
			V_{CC} = 4.5 V			53	
			V_{CC} = 6.0 V			45	
Propagation delay time, CLR to Qn (see figure 3) 3/	t_{PHL2}, t_{PLH2}	T_C = +25°C, C_L = 50 pF ±10%	V_{CC} = 2.0 V	9		205	ns
			V_{CC} = 4.5 V			41	
			V_{CC} = 6.0 V			35	

See footnotes at end of table.

TABLE I. Electrical peformance characteristics - Continued.

Test	Symbol	Conditions 1/ $-55°C \le T_C \le +125°C$ unless otherwise specified		Group A subgroups	Limits		Unit
					Min	Max	
Propagation delay time, CLR to Qn (see figure 3) 3/	t_{PHL2}, t_{PLH2}	T_C = -55°C, +125°C C_L = 50 pF ±10%	V_{CC} = 2.0 V	10, 11		310	ns
			V_{CC} = 4.5 V			62	
			V_{CC} = 6.0 V			53	
Transition time (see figure 3) 4/	t_{THL}, t_{TLH}	T_C = +25°C C_L = 50 pF ±10%	V_{CC} = 2.0 V	9		75	ns
			V_{CC} = 4.5 V			15	
			V_{CC} = 6.0 V			13	
		T_C = -55°C, +125°C C_L = 50 pF ±10%	V_{CC} = 2.0 V	10, 11		110	
			V_{CC} = 4.5 V			22	
			V_{CC} = 6.0 V			19	

1/ For a power supply of 5 V ±10 percent, the worst case output voltages (V_{OH} and V_{OL}) occur for HC at 4.5 V. Thus, the 4.5 V values should be used when designing with this supply. Worst case V_{IH} and V_{IL} occur at V_{CC} = 5.5 V and 4.5 V, respectively. (The V_{IH} value at 5.5 V is 3.85 V.) The worst case leakage currents (I_{IN}, I_{CC} and I_{OZ}) occur for CMOS at the higher voltages; therefore, the 6.0 V values should be used. Power dissipation capacitance (C_{PD}), typically 150 pF, determines the no load dynamic power consumption, $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$, and the no load dynamic current consumption, $I_S = C_{PD} V_{CC} f + I_{CC}$.

2/ The V_{IH} and V_{IL} are not required and shall be used as forcing functions for the V_{OH} and V_{OL} tests.

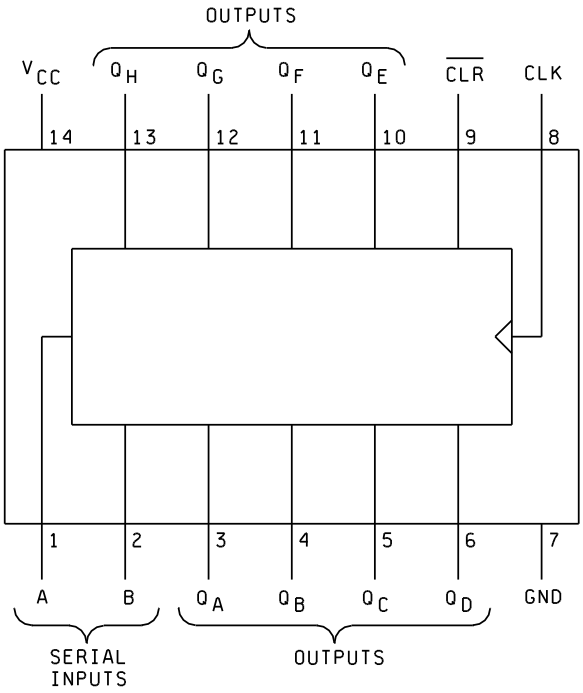
3/ Propagation delay times, when V_{CC} = 2.0 V and V_{CC} = 6.0 V shall be guaranteed if not tested to the specified limits shown in table I.

4/ Transition times (t_{THL} and t_{TLH}), if not tested, shall be guaranteed to the specified limits shown in table I.

3.7. Notification of change. Notification of change to DESC-ECS shall be required in accordance with MIL-STD-883 (see 3.1 herein).

3.8 Verification and review. DESC, DESC's agent, and the acquiring activity, retain the option to review the manufacturer's facility and applicable required documentation. Offshore documentation shall be made available onshore at the option of the reviewer.

CASES B, C, AND D



CASE 2

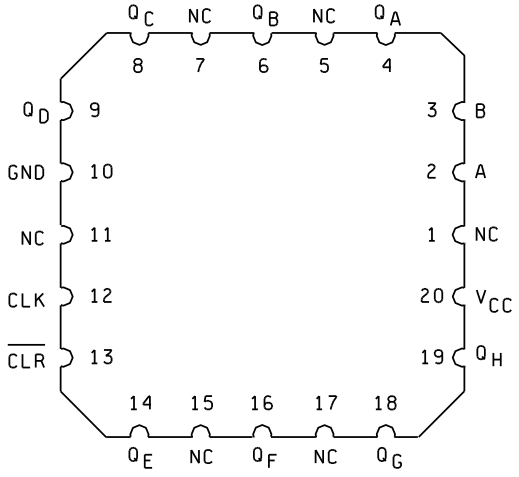
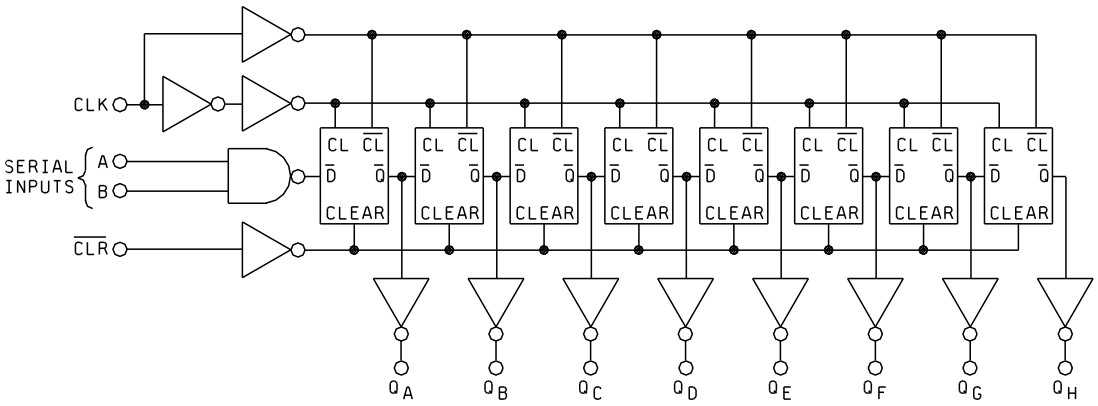


FIGURE 1. Terminal connections (top view).

STANDARDIZED MILITARY DRAWING DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444	SIZE A		84162
		REVISION LEVEL B	SHEET 8

DEVICE TYPE 01



INPUTS				OUTPUTS			
$\overline{CLR}$	CLK	A	B	Q_A	Q_B	...	Q_H
L	X	X	X	L	L		L
H	L	X	X	Q_{A0}	Q_{B0}		Q_{H0}
H	↑	H	H	H	Q_{An}		Q_{Gn}
H	↑	L	X	L	Q_{An}		Q_{Gn}
H	↑	X	L	L	Q_{An}		Q_{Gn}

FIGURE 2. Logic diagram and truth table.

DEVICE TYPE 01

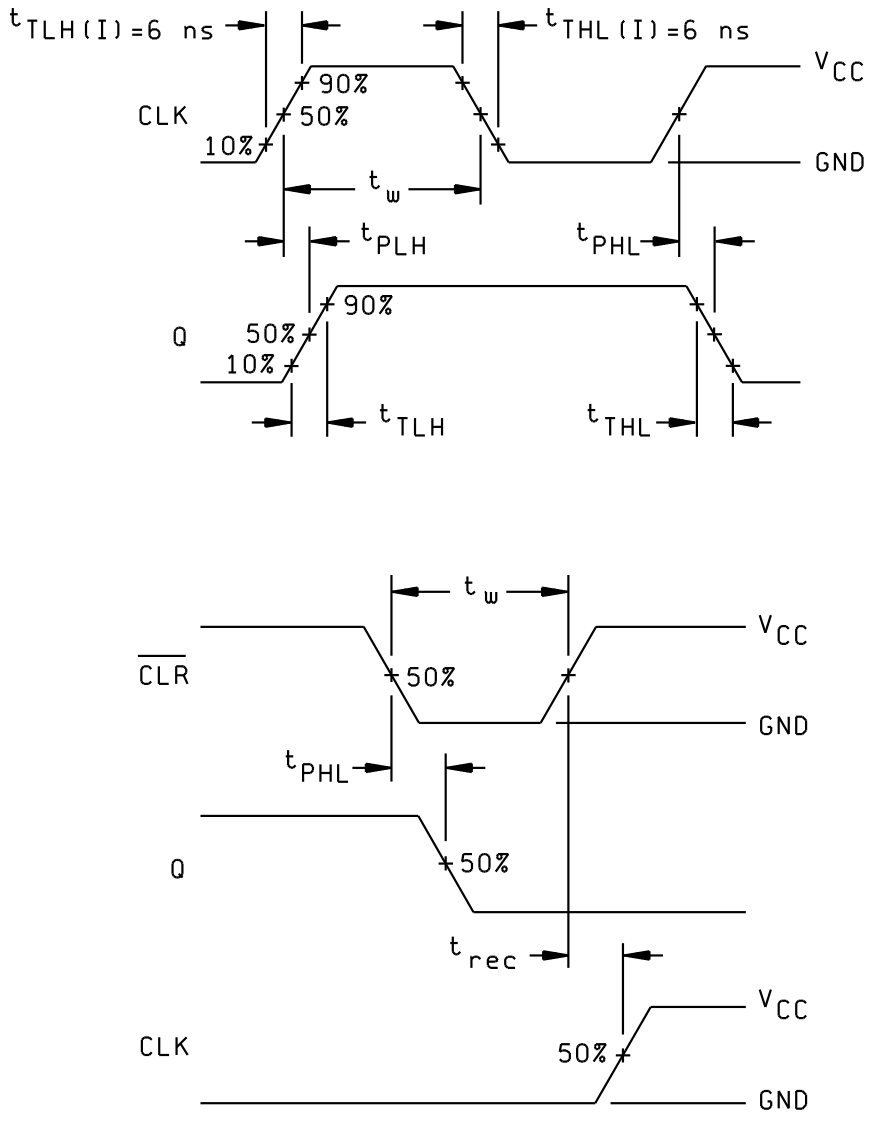


FIGURE 3. Output waveforms.

4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection procedures shall be in accordance with section 4 of MIL-M-38510 to the extent specified in MIL-STD-883 (see 3.1 herein).

4.2 Screening. Screening shall be in accordance with method 5004 of MIL-STD-883, and shall be conducted on all devices prior to quality conformance inspection. The following additional criteria shall apply:

a. Burn-in test, method 1015 of MIL-STD-883.

(1) Test condition A, B, C, or D using the circuit submitted with the certificate of compliance (see 3.5 herein).

(2) T_A = +125°C, minimum.

b. Interim and final electrical test parameters shall be as specified in table II herein, except interim electrical parameter tests prior to burn-in are optional at the discretion of the manufacturer.

4.3 Quality conformance inspection. Quality conformance inspection shall be in accordance with method 5005 of MIL-STD-883, including groups A, B, C, and D inspections. The following additional criteria shall apply.

4.3.1 Group A inspection.

a. Tests shall be as specified in table II herein.

b. Subgroups 5, 6, and 8 in table I, method 5005 of MIL-STD-883 shall be omitted.

c. Subgroup 4 (C_{IN} measurement) shall be measured only for the initial test and after process or design changes which may affect capacitance. Test all applicable pins on five devices with zero failures.

d. Subgroup 7 test shall verify the truth table as specified on figure 2.

4.3.2 Groups C and D inspections.

a. End-point electrical parameters shall be as specified in table II herein.

b. Steady-state life test conditions, method 1005 of MIL-STD-883.

(1) Test condition A, B, C, or D using the circuit submitted with the certificate of compliance (see 3.5 herein).

(2) T_A = +125°C, minimum.

(3) Test duration: 1,000 hours, except as permitted by method 1005 of MIL-STD-883.

TABLE II. Electrical test requirements.

MIL-STD-883 test requirements	Subgroups (per method 5005, table I)
Interim electrical parameters (method 5004)	
Final electrical test parameters (method 5004)	1*, 2, 9
Group A test requirements (method 5005)	1, 2, 3, 4, 7, 9, 10**, 11**
Groups C and D end-point electrical parameters (method 5005)	1, 2, 3

* PDA applies to subgroup 1.
** If not tested, subgroups 10 and 11 shall be guaranteed to the specified limits in table I.

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-M-38510.

6. NOTES

6.1 Intended use. Microcircuits conforming to this drawing are intended for use when military specifications do not exist and qualified military devices that will perform the required function are not available for OEM application. When a military specification exists and the product covered by this drawing has been qualified for listing on QPL-38510, the device specified herein will be inactivated and will not be used for new design. The QPL-38510 product shall be the preferred item for all applications.

6.2 Replaceability. Replaceability is determined as follows:

a. Microcircuits covered by this drawing will replace the same generic device covered by a contractor prepared drawing.

b. When a QPL source is established, the part numbered device specified in this drawing will be replaced by the microcircuit identified as part number M38510/66501B--.

6.3 Comments. Comments on this drawing should be directed to DESC-ECS, Dayton, OH 45444, or telephone 513-296-5375.

6.4 Approved sources of supply. Approved sources of supply are listed herein. Additional sources will be added as they become available. The vendors listed herein have agreed to this drawing and a certificate of compliance (see 3.5) has been submitted to DESC-ECS.

Military drawing part number	Vendor CAGE number	Vendor 1/ similar part number	Replacement military specification part number
8416201BX	2/	SNJ54HC164WA	M38510/66501BBX
8416201CX 3/	01295 04713 18714 27014	SNJ54HC164J 54HC164/BCAJC CD54HC164F/3A MM54HC164J/883B	M38510/66501BCX
8416201DX	01295	SNJ54HC164W	M38510/66501BDX
84162012X 3/	01295 04713 27014	SNJ54HC164FK 54HC164M/B2CJC MM54HC164E/883	M38510/66501B2X

1/ Caution. Do not use this number for item acquisition. Items acquired to this number may not satisfy the performance requirements of this drawing.
2/ Inactive for new design. No approved source of supply is available.
3/ Inactive for new design. Use M38510/66501B-- QPL device.

Vendor CAGE number	Vendor name and address
01295	Texas Instruments, Incorporated P. O. Box 6448 Midland, TX 79711-0448
04713	Motorola Incorporated 7402 S. Price Road Tempe, AZ 85283
18714	Harris/RCA Corporation Route 202 Somerville, NJ 08876
27014	National Semiconductor 2900 Semiconductor Drive Santa Clara, CA 95051